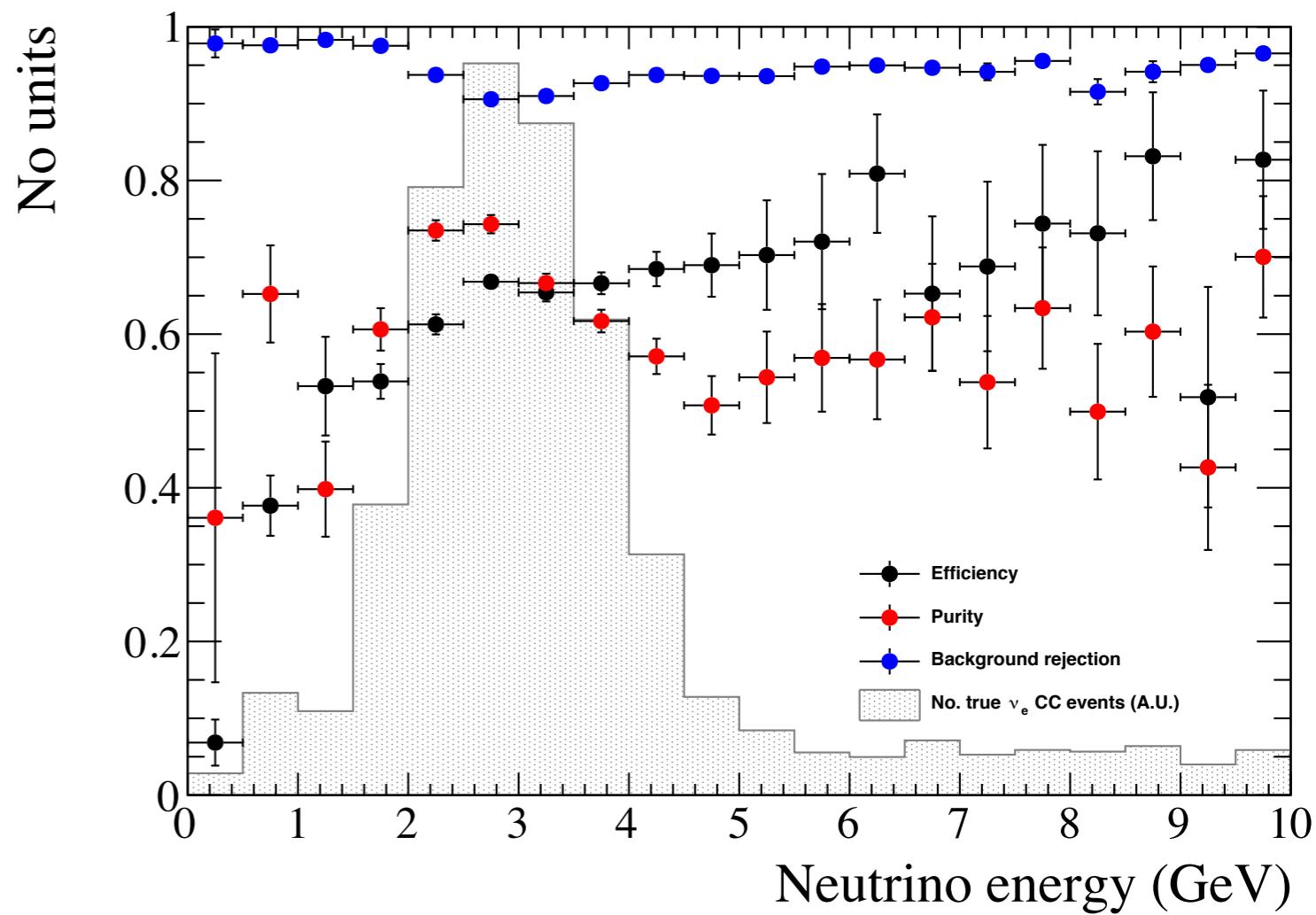


Expanding the Warwick PID for electrons

Dom Brailsford
UK reco meeting
2nd March 2021

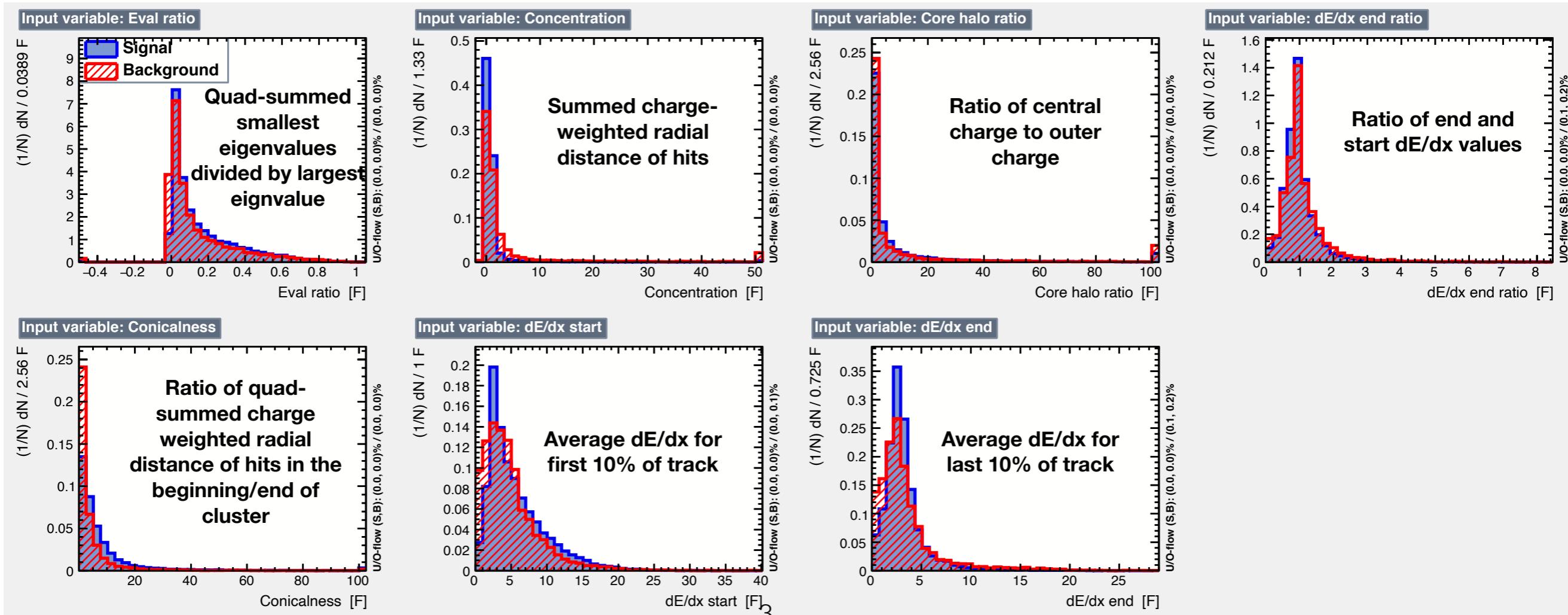
The CC nu_e selection (last time)

- Selection consists of:
 - Pandizzle muon PID to reject muons
 - Warwick PID to select electrons
 - Displacement between shower and nu vertex to select electrons
- Achieved a modestly respectable
 - **64% efficiency**
 - **58% purity**
 - **95% background rejection**
- RHS plot shows selection metrics vs true neutrino energy
- The rest of this (very short) talk is my attempt to expand (and rename) the Warwick PID

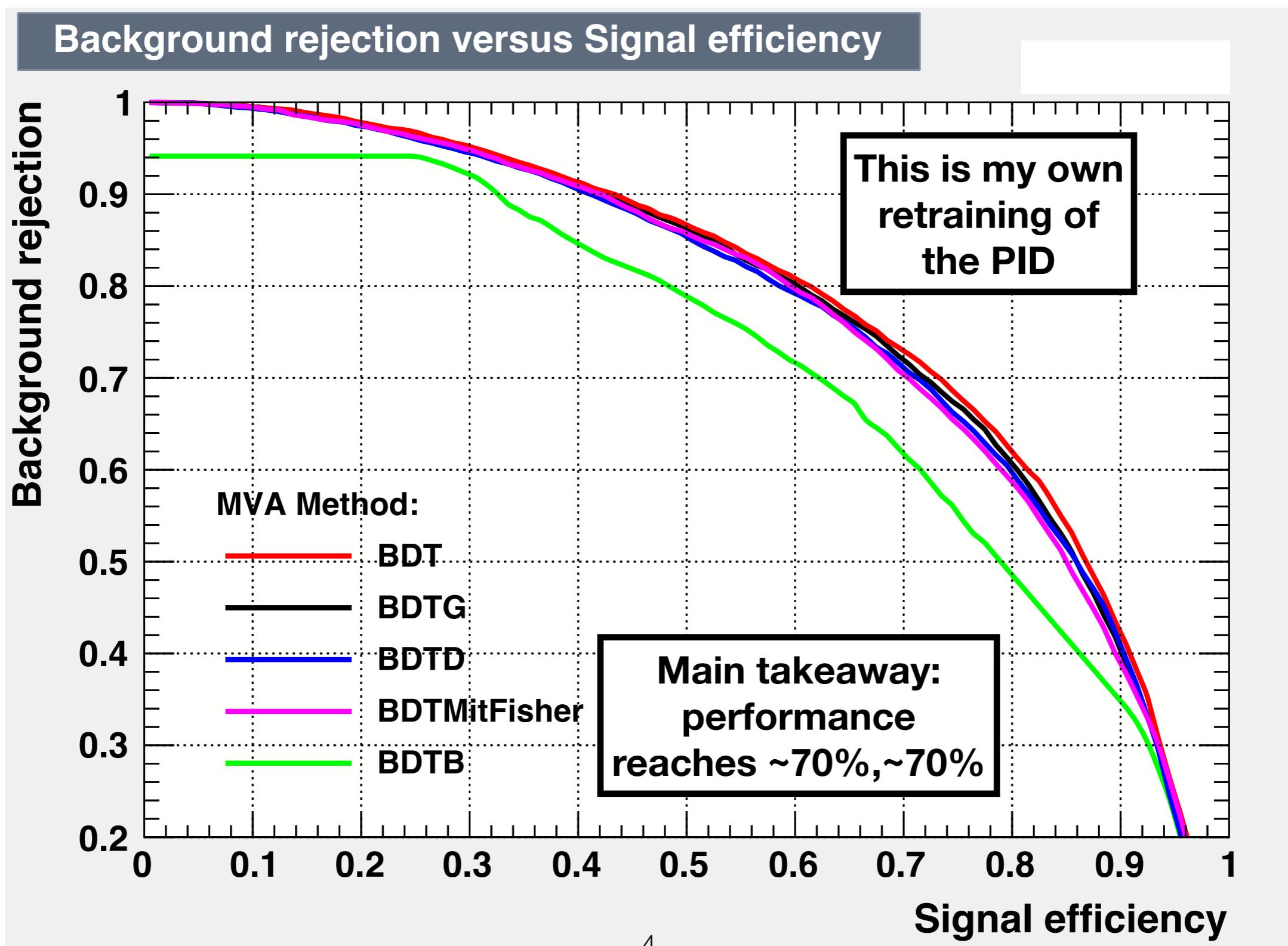


The Warwick PID

- MVA-based PID developed by J. Haigh and N. Grant
- Warwick PID is actually five similar MVAs
 - Each MVA uses the same input but swaps signal for a different particle type (muon, proton, charged pion, electron, photon)
- All input variables revolve around a line fitted to the centroid of a 3D cluster
- Plots below show the inputs.
 - **Signal == electron shower and background == other showers. Events are ‘nue’ flavour swap neutrinos**
 - **NB Signal is —NOT— cc_nue**

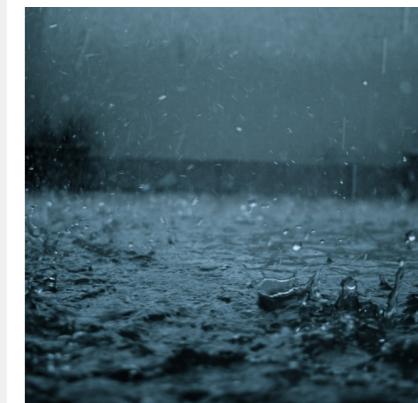
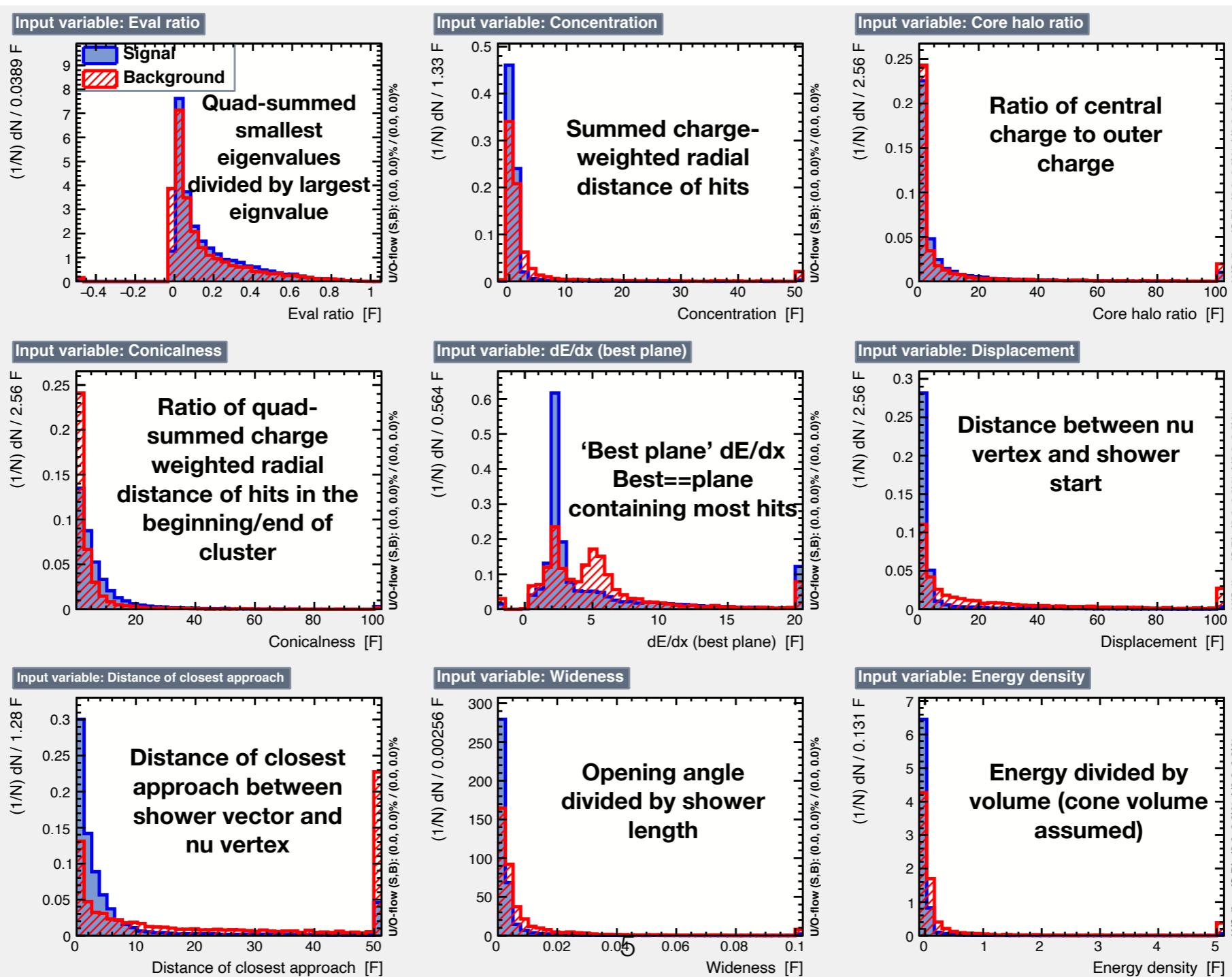


Warwick PID ROC curve



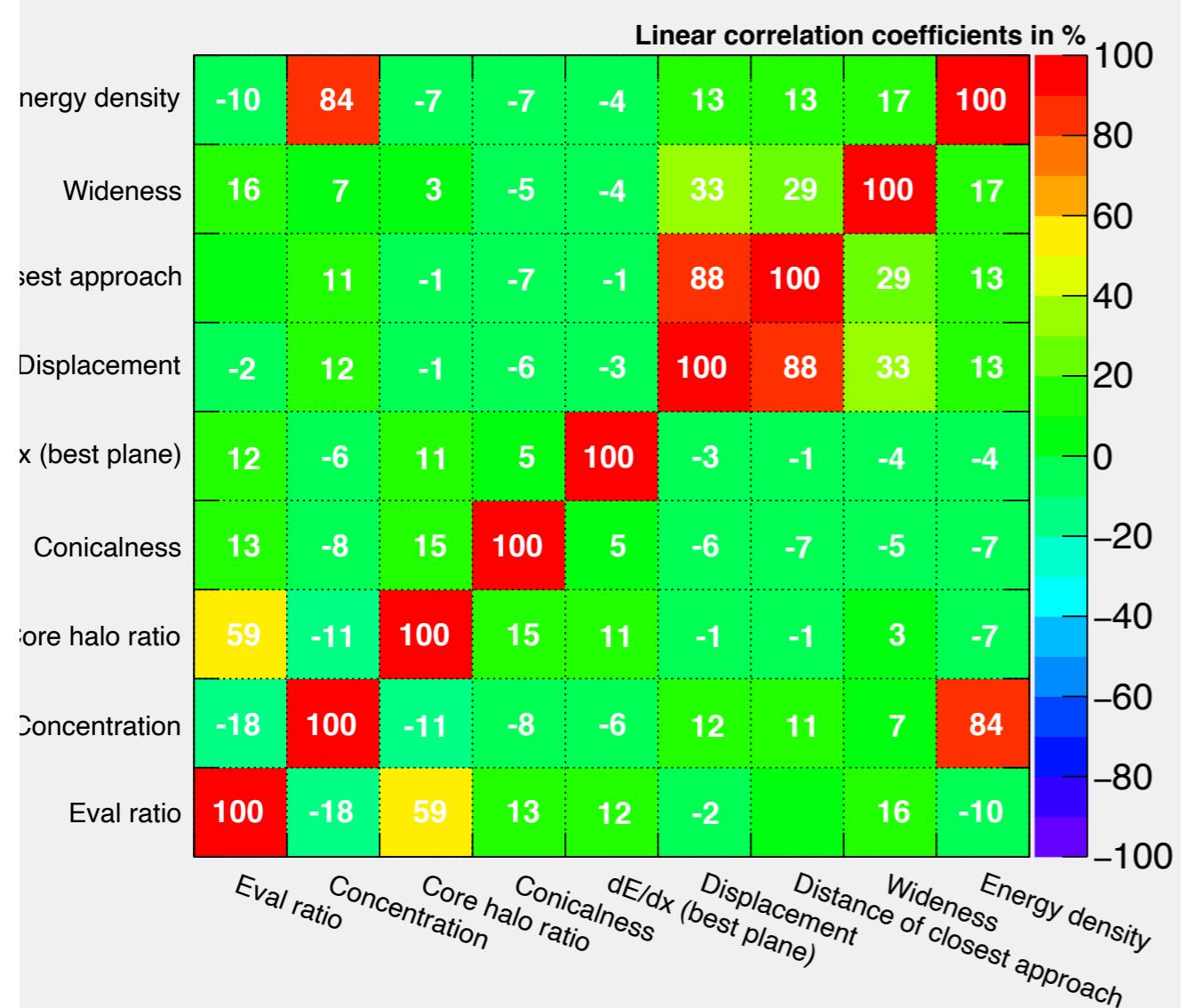
The Pandrizzle electron PID

- Pandrizzle PID: my attempt at expanding the Warwick PID to incorporate the latest PandoraModularShower Reco + some extra variables
- Inputs shown below
 - Signal == electron shower and background == other showers. Events are ‘nue’ flavour swap neutrinos

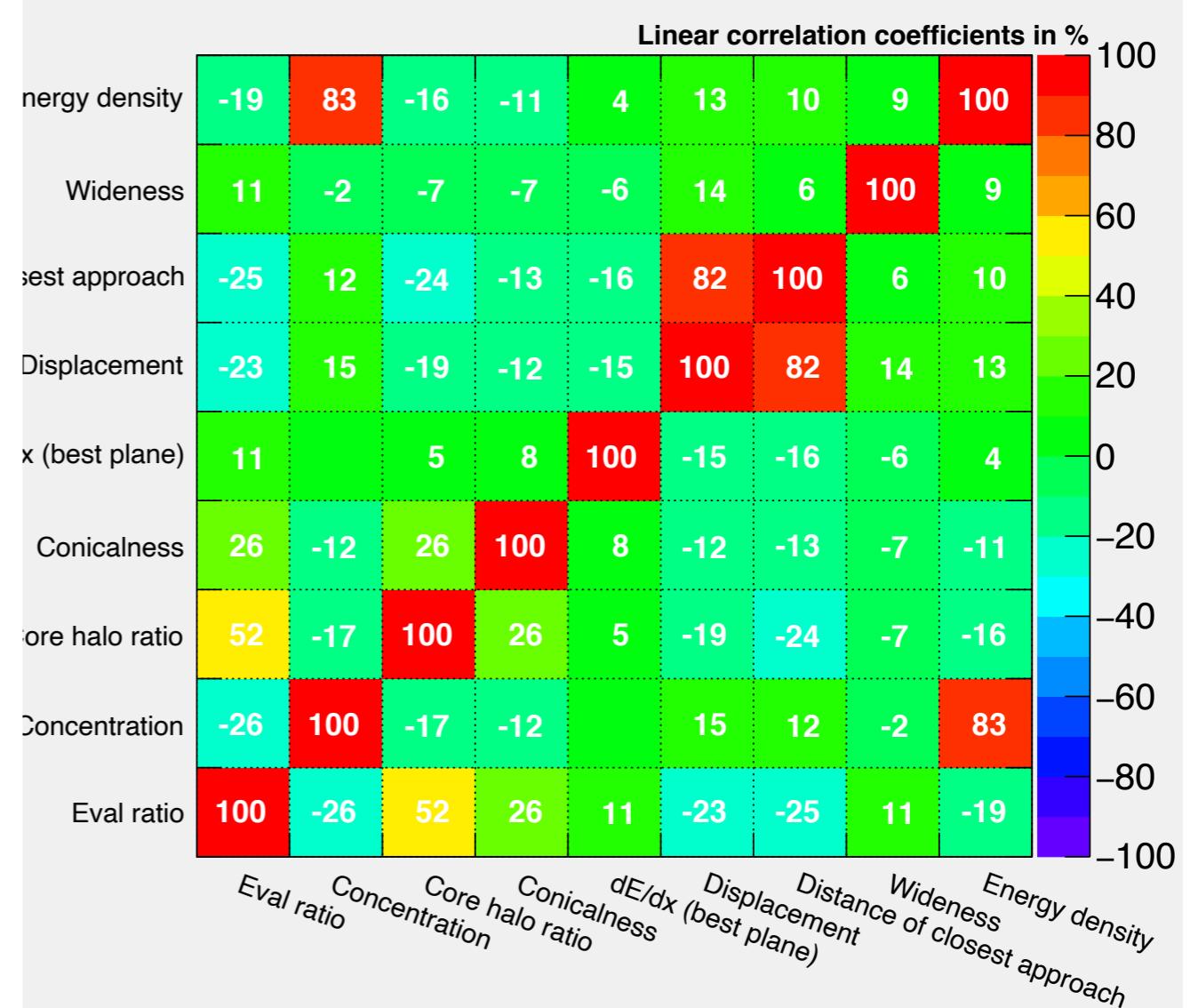


Pandrizzle correlations

Correlation Matrix (signal)

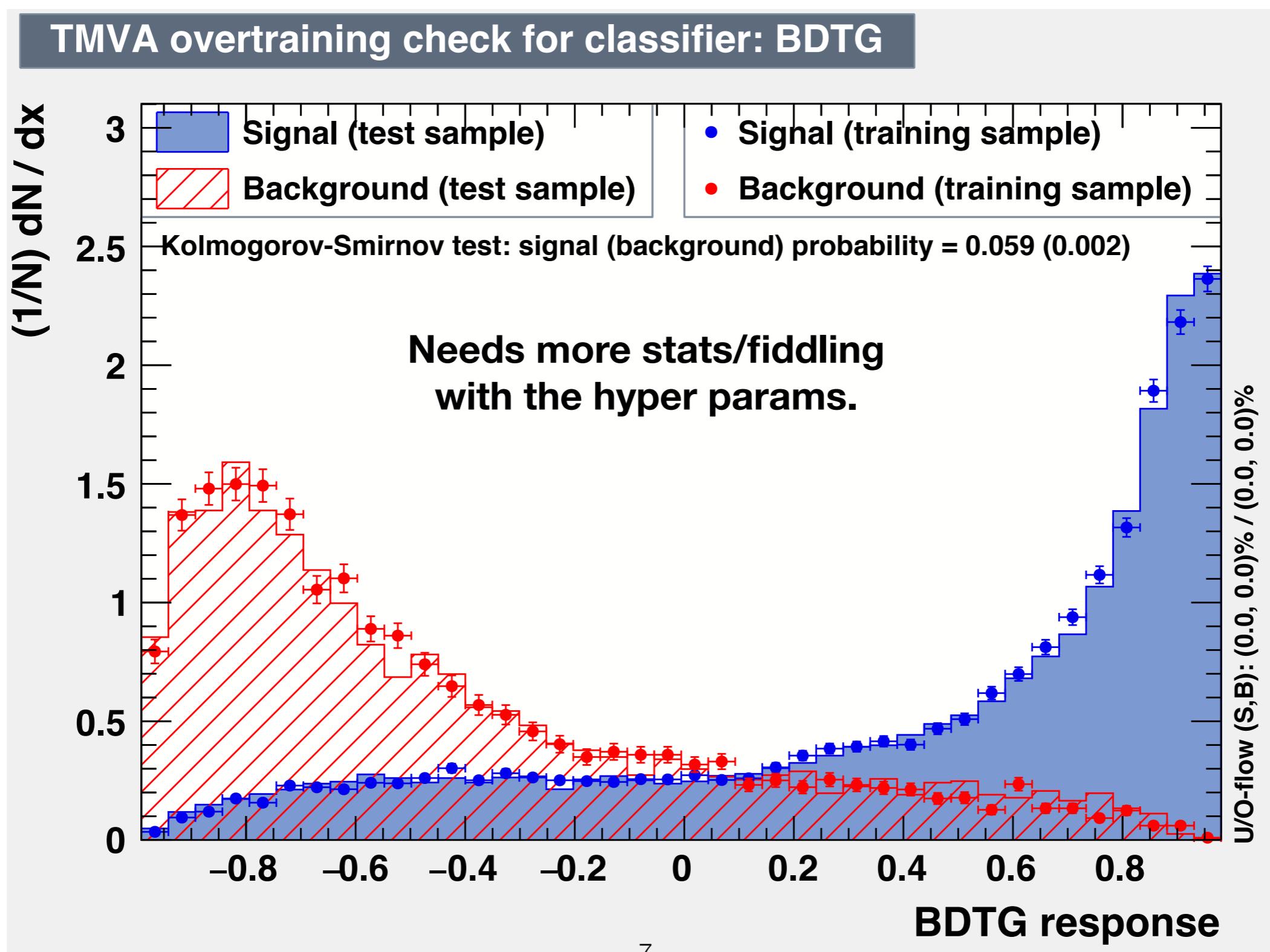


Correlation Matrix (background)



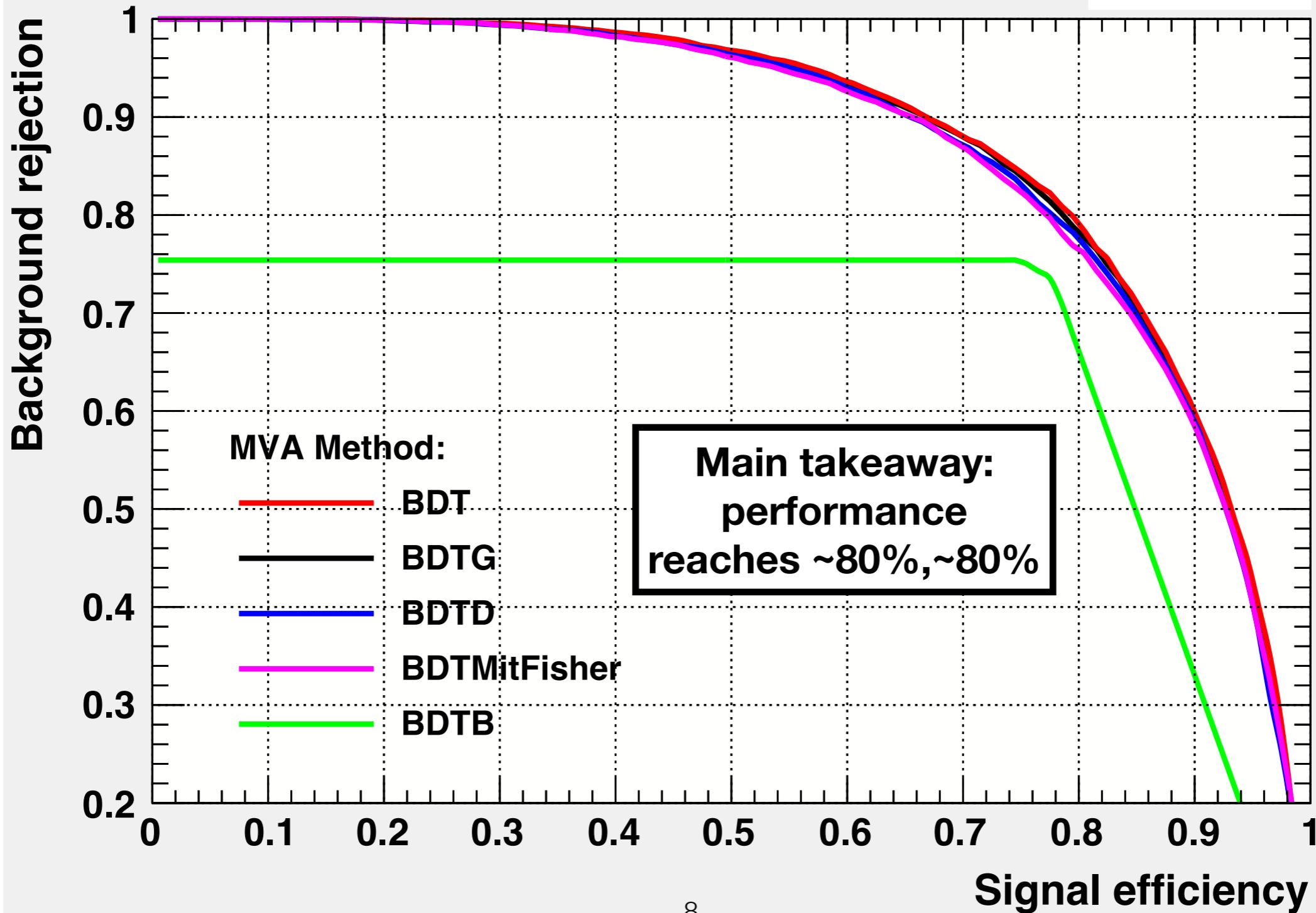
Oops...

Pandrizzle response (BDTG)



Pandrizzle ROC

Background rejection versus Signal efficiency



Summary and what's next

- CC nu_e selection used Warwick PID to select electron showers
- Warwick PID achieves a ~70% electron shower retention and ~70% other shower rejection when looking at DUNE nu_e events
- Pandrizzle PID: cracking open the Warwick PID, removing stuff and adding stuff
 - Achieves ~80% for both electron shower retention and other shower rejection
- Need to:
 - investigate each variable's biases/impact
 - Propagate the new PID to the CC nu_e selection